

Financial Liberalization and Monetary Control in Korea*: An Analytical Framework

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This paper describes current developments of financial liberalization and internationalization in Korea since the early 1980s. The method of current monetary control and some implications of financial reforms to Korean monetary policy are also discussed. How monetary growth targets can be achieved in harmony with stabilizing the movements of interest rates and maintaining targeted exchange rates in a small open-developing economy with a managed exchange rate and a domestic market that is being liberalized? The extended and modified Mundell-Flemming model for an analytical framework is used to answer the above policy question.

I. Introduction

Great changes have undergone in the world of financial environment since the 1980s. The transition of the financial and monetary arrangements have been manifested by numerous market innovations, conflicts between the market and the regulatory authorities, changes in the tactics and strategy of monetary policy. The transition is not unique to a specific country, however. Similar changes have occurred in a variety of developed and developing countries despite vast differences among the countries with respect to their economic and social structure, their degree of financial and monetary complexity, and their historical background.

Three characteristics of the transition in the financial markets suggest that countries are responding in a similar way to a similar economic en-

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vironment. First is financial liberalization. Financial structures appear to be converging into structures that permit competitive and market forces a great role in the financial system than previously. Second is financial innovation. The majority of countries have experienced common elements of the new economic and technological innovations such as increased productivity of producing financial services made possible by the rapid computerization of financial transactions. Third is financial internationalization. International financial transactions have been gradually liberalized. Together with the financial liberalization, the abolition of the regulations on foreign exchange transactions and a vast expansion in the scale of cross-border capital movements have accelerated financial internalization, bringing about a situation in which international financial markets are tending to move toward financial globalization.

In keeping with this worldwide trend, Korea too has been steadily pursuing financial liberalization since the early 1980s. The government has shifted from direct intervention in managing the economy to greater reliance on the market mechanism. At the same time, various institutional factors and traditional practices limiting competition among financial institutions have been largely removed along with restrictions on their internal management. Through the introduction of a variety of new financial products, financial institutions have been able to expand their business sphere. The centerpiece of financial deregulation, interest rate liberalization, was put into place in December 1988, with the freeing of lending and long-term deposit rates.

In addition to financial liberalization, remarkable progress has been made in financial internationalization. Opportunities for foreign indirect investment in the Korean securities market have been considerably extended and opening of the insurance market has also been speeded up while domestic financial institutions have been actively diversifying their overseas networks. Furthermore, the regulations concerning foreign exchange and capital transactions have been lifted to a large extent and the role of the market mechanism in determination of the foreign exchange rate has been substantially enhanced.

Recent financial developments pose new challenges for achieving monetary stability. Dramatic changes in the financial system and the globalization of financial markets have greatly increased the difficulties of conducting an effective monetary policy. Now that the process of financial liberalization and internationalization is well underway, however, policy makers are faced with a different set of issues relating to interest rates, money supply, and foreign exchange rates in Korea. The focus has begun to shift away from investigating the effects of liberalizing interest rates

and capital controls to how interest rates and exchange rates are in fact determined once the domestic financial market has been liberalized. This is a very important policy issue because financial reform may have increased the variability and unpredictability of interest rates and exchange rates. How monetary growth targets can be achieved in harmony with stabilizing the movements of interest rates and maintaining optimal exchange rates through intervention in the foreign exchange market as well as adjustment of short-term interest rates? It is a main purpose of this paper to try to answer this question. Until now most studies that have analyzed the effect of stabilization policies in developing countries have not considered this kind of relationship between them from a policy perspective. The main reason for this negligence is that the experience with liberalized financial markets is still relatively recent.

In this paper, Section II describes current developments of financial liberalization and internationalization in Korea since the 1980s. In Section III the method of current monetary control and some implications of financial reforms to monetary policy are discussed. The model, which is described in Section IV, focuses on the process of the determination of interest rates and exchange rates in a small open economy with a managed exchange rate and a domestic financial market that is being liberalized. Although numerous studies have aimed to explain the determination of interest rates and exchange rates within the framework of developed countries, there are few studies of theoretical and empirical work about this issue in an open developing countries.¹ The concluding section summarizes the main points and indicates some limitations of the model in actual application to the empirical model.

II. Current Developments of Financial Liberalization and Internationalization in Korea

A. *Financial Liberalization*

As the Korean economy grew much larger and more complex, it reached a stage where entrusting the management of the economy to government's initiative was believed to be less efficient than leaving it to the market mechanism. In addition, it was widely accepted that the Korean economy could not progress much further without adequate development

¹ The studies, theoretical and empirical, in developing countries include Mathieson (1982, 1985) on Argentina and Chile respectively; Blejer and Gil Diaz (1985) on Uruguay; Edwards and Kahn (1985) on Singapore and Columbia.

of the financial sector. Wide-ranging structural adjustment policies were therefore implemented from the early 1980s. In the parallel with the changes in the real sector, a number of measures were also taken for liberalization and promotion of competition in the financial sector.

There was a substantial change in the environment of the financial sector in the mid-1980s. In 1986, the current account shifted into surplus from deficit, alleviating the chronic difficulty of a shortage of domestic savings in the national economy. Therefore, the demand for financial assets greatly increased and became more diversified. To cope with the changes in economic and financial environments, the government actively pursued financial liberalization and internationalization.

1) Relaxation of Entry Barriers

The government handed over the ownership of four nationwide commercial banks to private hand in 1981-1982. With the other nationwide bank already privately owned since 1972, the denationalization of all the five leading commercial banks was complete.

As a measure to provide a more competitive environment in the financial market, two new nationwide commercial banks were opened in 1982-1983. In addition, entry barriers were substantially lowered for such non-bank financial institutions as investment and finance companies, and mutual savings and finance companies in 1982. As a result, there has been a notable increase in the number of non-bank financial institutions.

Entry barriers have been relaxed further since 1988 to facilitate competition in the financial services industry. Three new commercial banks were established. These newly opened banks were established for the purpose of serving small and medium-sized enterprises. In a further major move, Korean Exchange Bank, the Korean bank with the largest volume of international transactions and the largest international branches, was privatized at the end of 1989.

A number of additional non-bank financial institutions were established. Five regionally-based securities investment trust companies were set up in 1989 and, in the four year period from 1987 to 1990, eighteen life insurance companies were established. The latter comprised thirteen domestic companies and five joint-venture companies. In addition, further four foreign life insurance companies were allowed to open branches in Seoul.

2) Deregulation of Banking Operations

The General Banking Act was amended in 1982 to give commercial banks more autonomy in their internal management and other opera-

tional matters. Closely related to this, the size of a single shareholder's stake in the equity capital of a commercial bank was limited to a maximum of eight percent of the total to prevent any individual or large business group from exercising excessive managerial influence over a bank's affairs. In addition, the commercial banks have all greatly increased their paid-in capital, thus boosting their competitiveness and raising their international stature.

The business scope of financial institutions has been widened since the early 1980s. Commercial Banking business has been diversified to include the sales of commercial bills, credit card business, sales of government and public bonds under repurchase agreements (RPs), factoring business, trust, mutual installment savings business and negotiable certificates of deposits (CDs) business. In non-bank financial institutions, the commercial paper (CP) was introduced for investment and finance companies and merchant banking corporations in 1981 and for large securities companies in 1984. Cash Management Accounts (CMA), a Korean version of the U.S. Money Market Mutual Funds (MMF), were introduced in 1984 for investment and finance companies and merchant banking corporations. They have much greater freedom in setting dividends and restrictions on establishment of branch offices have been considerably relaxed.

3) Deregulation of Interest Rates

Interest rates in Korea had been regulated by the monetary authorities to implement the Economic Development Plans more efficiently rather than determined by the demand and supply of funds in the market. However, a substantial step toward financial liberalization was taken in December of 1988.

Most of the lending rates of banks and non-bank financial institutions, except those for government funds, were liberalized. All interest rates on loans and long-term deposits exceeding two years were deregulated. Previous to this, banks had only been permitted to charge different rates on loans within a narrow band. Interest rates on money market instruments such as certificates of deposit, repurchase agreements, commercial paper, and those on financial debentures, and corporate bonds were also deregulated. In addition, inter-bank call rates and issuing rates of non-guaranteed corporate bonds were completely liberalized in 1990.

But looking back on three years of experience under the system of the deregulation of interest rates, it would be difficult to say that interest rates have functioned as adequately as was expected in view of financial liberalization. Though the lending rates of the financial institution are institutionally liberalized, most lending rates of banks are still subject to

control by the monetary authorities. The monetary authorities also interfere in the determination of interest rates on money market instruments, directly or indirectly.

The structure of interest rates in Korea has the following leading characteristics:

First, prime lending rate of banks is lower than the yields of non-risk bonds such as guaranteed corporate bonds or government bonds.

Second, the level of regulated interest rates on deposits of banks is lower than that of non-bank financial institutions.

B. Financial Internationalization

1) Expansion of Domestic and Foreign Banks' Activities

Since the latter half of the 1970s, domestic banks' overseas banking networks have expanded rapidly in pace with the rapid growth of cross-border transactions. They are also diversifying their overseas networks by establishing merchant banks in addition to the existing branches which engage mostly in commercial banking. In this way, they are extending the scope of their international activities in loan syndication, the underwriting of bonds, securities investment, and so forth. These developments are expected to lead to a diversification of earning sources and an increase in their profitability. Domestic banks had 48 overseas branches, 33 subsidiaries and 52 representative offices, bringing the total number of overseas establishments to 143 at the end of December 1990.

Meanwhile foreign bank branches increased rapidly during the 1970s and 1980s due to their relatively advantageous business circumstances vis-à-vis domestic commercial banks. At the end of December 1990, there were 69 foreign bank branches and 24 representative offices in Korea from 17 countries. The chief motive in encouraging the entry of foreign banks had been to promote the inflow of foreign capital needed to finance industrial development and the current account deficit which inevitably accompanied it. However, as the chronic current account deficit has shifted to an underlying pattern of surplus since 1986, the regulatory climate in which foreign banks operate has undergone certain changes. It is now hoped that they will serve as catalysts in motivating domestic banks to improve their banking practices and managerial skills rather than in introducing foreign capital.

In this regard, the preferential treatment of foreign bank branches has been diminished, but at the same time discriminatory restrictions on their operations have been progressively scaled back. Foreign banks were given

higher lending limits by allowing increases in their operating funds, upon which lending limitations are based. In 1989, the upper limit of their "Kap-Funds" was raised to 12 million won. Foreign banks have also been granted access to the central bank's rediscount facility on the same terms as domestic banks, and permitted to issue negotiable certificates of deposit (CDs) and to engage in trust business. The ceiling on the issue of CDs has been raised by stages and this process continues.

In the attempt to achieve national treatment, however, these improvements in their position have been accompanied by the imposition on them of the same obligations as apply to domestic banks. These obligations require foreign banks to lend a certain proportion of their funds to small and medium businesses, and to comply with measures concerning domestic monetary management. At the same time, there was a progressive reduction of guaranteed profits available to them in swap transactions with the central bank.

In this newly emerging policy environment, foreign banks are expected to take on an increasingly diverse role. Once viewed primarily as a conduit of foreign capital, foreign banks are now viewed as innovators, introducing advanced banking techniques to the Korean financial sector.

2) Relaxation of Foreign Exchange Controls

During 1990, the government took a series of measures to activate the foreign exchange market, placing particular emphasis on boosting the price function of the exchange rate.

These measures, prompted by the need to cope efficiently with trends toward the globalization of financial markets and the continuing process of liberalization and internationalization of the Korean economy, constituted a decisive step toward a freely floating exchange rate regime.

Since September 1989, foreign exchange banks have been given discretion in setting their basic customer rates within a certain band and in March 1990, the government adopted a new exchange rate system, termed the market-average exchange rate system, as part of efforts to move to a fully-fledged system of market-based determination of exchange rates.²

Under this system, the daily exchange rate of the Korean won against

² The foreign exchange rate in Korea were long posted by the Bank of Korea on the basis of the Special Drawing Rights (SDR) basket and the trade-weight of basket of five major foreign currencies. This multi-basket-peg exchange regime was used for ten years from February 1980.

the U.S. dollar, the market-average exchange rate, is determined by weighted averaging of the rates at which won-dollar transactions were conducted in the previous business day's transactions between foreign exchange banks. This basic exchange rate, termed the market-average rate replaces the won-dollar Bank of Korea concentration base rate which, under the previous system, was calculated on the basis of the SDR basket and a trade-weighted basket by averaging the two basket rates according to their assigned weights.

Furthermore, in an effort to speed up the activation of the foreign exchange market, a revised management system of exchange position was adopted from September 1989. Under the earlier system the overbought position ceilings on foreign exchange banks varied according to the category of bank between 20 percent and 250 percent of the average value of bills bought and held in the previous month. However, under the new system the ceiling for each foreign exchange bank is an amount equivalent to twice the average value of bills bought and held by it in the previous month, or US\$20 million, whichever is the greater; all foreign exchange banks should maintain overbought spot-exchange positions equivalent to at least 2% of the average value of bills bought and held by them in the previous month.

Moreover, the government eased the restrictions on forward exchange transactions. Previously, when foreign exchange banks wished to engage in forward exchange transactions, they were required to confirm a written contract of foreign currency receipt or foreign currency payment before entering into an agreement on a forward exchange transaction. However, since September 1989, banks have been permitted to confirm such a written contract after entering into an agreement on a forward exchange transaction of less than US\$500 thousand.

As part of efforts to activate interbank foreign exchange transactions, the Foreign Exchange Market Council, managed autonomously by participant banks, was inaugurated officially in December 1989, and the government introduced a professional brokerage system in the foreign currency call money market to adjust temporary shortages or surpluses of foreign currency funds among foreign exchange banks.

3) Promotion of Capital Market Internationalization

Korea has promoted a progressive liberalization of the capital market in line with the liberalization of trade and foreign exchange transactions. A blueprint for capital market internationalization was first announced in 1981. Several international trust funds, such as the Korea Fund and the

Korea-Europe Fund were established for foreign investors. Foreign securities companies were allowed to open representative offices and to own up to 10 percent of the paid-in capital of large Korean securities companies from 1985. The ratio was increased to 40 percent in 1989. From 1987, large Korean securities companies, investment trust companies, and insurance companies have been allowed to make direct investments in foreign capital markets.

According to the schedule announced in December 1988, indirect investment possibilities for foreigners have been enlarged by the establishment of a new fund such as Matching Fund. Branches of foreign securities companies and joint-venture securities companies were allowed on a reciprocal basis from 1991. Non-residents are able to invest directly in the domestic securities market from 1992, although certain limits will be set on the extent of such investment.

III. The Current Method of Monetary Control and Implications of Financial Reforms

A. Monetary Targeting and Policy Instruments

There is every expectation that the liberalization and internationalization of the Korean financial system will continue along with the appearance of various financial innovations. The real issue in the face of these changes in the financial environment is the management of monetary policy and its effectiveness to stabilize the economy.

The transmission mechanism for monetary policy goes from policy instruments to operation variables, next to intermediate targets, and then to final objectives. The Bank of Korea conducts its financial adjustments in rediscounts, open market operations, and changes in reserve requirement ratios as its operating variables. Continuous attention is paid to the change in M2, broadly defined money or the sum of currency in circulation and total deposits of banking institutions, as the intermediate target. M1, narrow money, and M3, the broadest monetary aggregate comprising M2 plus the liabilities of non-bank financial intermediaries, are used as supplementary monetary indicators.

The monetary targeting implemented by the Bank of Korea has had four major features. First, one reason for the selection of M2 as the intermediate target is based on the close relationship with nominal income and price level, in the sense that affects the latter two variables in the future. The results of empirical analysis by the Bank of Korea indicate

that M2 has the closest relationship with the potential movements of nominal income and inflation in the future. However, various debates regarding the empirical findings on M2 and inflation are still going on among scholars in Korea. A second reason for using M2 is its superior controllability. There are rather strict limits on the ability to exert a short-term control over M1. It is difficult to control the short-term shifts of funds between M1 and time deposits. However, such shifts are only compositional shifts within the M2 definition, so that the control of the total amount of credit granted by banks allows control even in the short run of the total amount of M2. Third, the annual target growth rate of M2 is determined in close collaboration with the government and in consideration of major macroeconomic targets for the year, such as growth rate of real GNP, tolerable inflation rate, target level of balance of payments and so on. The targeted level of M2 for the year is estimated on the base of economic growth expectation, expected inflation rate and forecasted changes in velocity of money mainly by use of the quantity equation. Fourth, when the annual target of M2 is determined, the Bank sets up quarterly management plans. In setting the short-term targets, the Bank takes into consideration such factors as seasonal fluctuations of the demand for money in the private sector, scheduled outlays of public expenditure, and prospects for foreign trade and capital movements.

The monetary growth targets of M2 and actual outcomes are shown in Table 1. The Bank of Korea, in general, has not been successful in achieving stated monetary targets. Although the money growth targets declined until 1985, after that year then began to rise again. Increased money growth in 1986-1987 reflected the excessive supply of liquidity through the foreign sector. The current account reversed to an ample surplus from a chronic deficit as a result of a trade surplus and a remarkable improvement in the invisible trade balance in 1986. Although the path of M2 for the years, 1987-1990 has moved a little bit outside the target range, the actual growth rates of M2 was fairly close to the top of target range.

As a result of financial deregulations, there will be an increase in the share of assets within M2 that reflect market interest rates, and as a result M2 will become gradually more sensitive to movements in the market interest rates. Moreover, an increase in the growth rates of M2 and M3 may be expected because asset selection for investment motives will increase its concentration on high-yielding safe assets that are included in M2 and M3. These changes in money demand will make some problems in the use of the definition of M2 as intermediate objectives for monetary policy. It is a possibility that it will become more difficult to control M2 because demands for the monetary aggregates respond quite sensitive to movements in market interest rates. There is also the possibility that M2 will

Table 1
MONETARY GROWTH TARGETS, 1979-1991

(Unit: percent)

Year	Target Range (M2)	Actual Growth Rate ¹⁾
1979	25.0	26.8
80	20.0	25.6
81	25.0	27.4
82	20.0-22.0	28.1
83	18.0-20.0	19.5
84	11.0-13.0	10.7
85	9.5	11.8
86	12.0-14.0	16.8
	(16.0-18.0) ²⁾	
87	15.0-18.0	18.8
88	15.0-18.0	18.8
89	15.0-18.0	18.4
90	15.0-19.0	21.2
91	17.0-19.0	18.3

Notes: 1) Based on yearly averages

2) Adjusted growth targets

Source: Bank of Korea, Monthly bulletin, various issues.

lose their function as leading indicators of policy objectives such as nominal GNP and prices. The practical effect of an interest-sensitive money demand will be a loose tie between money and income within a business cycle. The amount of money the public wishes to hold at any level of income or spending can vary substantially depending on the interest rates prevailing.

How should the intermediate target be achieved by some adjustments in operating variables? Until the 1970s, the BOK relied mainly on a reserve requirement policy and often direct control measures such as credit ceilings for individual banks to control money supply and domestic credit. Since the early 1980s, however, the BOK has made efforts to move gradually from a direct control system to an indirect system under which such orthodox instruments as rediscount rates and open market operations are utilized.

Direct lending through the discount window to commercial banks is the most flexible instrument employed by the BOK and hence is typically used to smooth fluctuations in the banking system's reserve position. Since there has been existed by chronic excess demand for bank credit, the official rediscount rates has been limited in the effect of control of bank lending. Accordingly, the interest rate policy mechanism of the BOK has not functioned well in Korea. Under these circumstances, the emphasis of the Bank's rediscount policy was placed on determining rediscount ratios and the availability of funds according to the bills concerned.

Open market operation in Korea had not been regarded as an important policy instrument until the current account balance moved into surplus. This was due to a shortage of marketable instruments which, in turn, reflected a notable gap between issuing rates and market interest rates. In fact, the government had been largely dependent on financing its fiscal deficits on borrowings from the BOK at low interest rates, rather than on the issue of government securities at money market rates.

Open market operation in Korea is a little bit different from the way done by the advanced countries. That is a kind of quasi-open market operation in nature. The Stabilization Bond Act enacted in 1961, authorizes the BOK to issue short-term (i.e., less than one year in maturity) bonds in its own name under terms specified by the Monetary Board.

Table 2
LOANS AND REDISCOUNTS OF THE BANK OF KOREA
(As of the end of 1991)

(Unit: billion won)

	Amount	Percentage of Total	Interest Rate (% p.a)
Rediscounts on commercial bills	5,487.6	42.3	7.0
Loans for export of financing	986.2	7.5	7.0
Loans for agriculture and fisheries	413.8	3.2	3.0
General loans	6,092.6	46.9	3.0-15.0
Other	7.9	0.1	—
Total	12,988.0	100.0	—

Source: Monthly Bulletin, The Bank of Korea.

As their name correctly implies, the bonds are used by the BOK to promote monetary stability. The legislation also authorizes the BOK to repurchase the bonds prior to maturity if credit conditions warrant such action.

Monetary Stabilization Bonds (MSBs) closely resemble U.S. TBs in that they have maturities under one year and sold on a discount basis. At the time of issue, the BOK allocates certain shares of the bonds to the main buyers, such as the commercial banks, savings institutions, securities companies, merchant banking corporations, insurance companies, and investment and finance companies. In recent years most of the bonds have been held by NBFIs. However, foreign banks are not required to participate in this compulsory allotment.

In the 1980s the volume of issues of the bonds fluctuated sharply from year to year, but the amount of outstanding bonds had been greatly increased since the year of large surpluses in the current account, 1986 as shown by Table 3. The market for MSB now ranks first, with the CP market ranking second. Thus, the volume of bond issues is usually increased by the BOK at such times in order to mop up excess liquidity and hence stabilize the value of the money supply. In this regard, the bonds have proven to be a very useful tool for the BOK to offset universal expansions of liquidity in the economy. However, this quasi-open market operation has its own limitations as increasing interest payments on the bonds themselves serve to increase the money supply. In addition, as the current account turned into deficits in 1990, it is very likely that the role of MSB will gradually decrease.

Table 3
TREND OF MSB ISSUANCE

(Unit: billion Won)

	1984	1985	1986	1987	1988	1989	1990
MSBs issued (Net)	408.1	-59.5	2,754.5	4,915.9	7,199.0	1,932.0	-1,694
MSBs outstanding (A)	563.6	504.1	3,285.6	8,174.5	15,373.5	17,305.5	15,611.5
Interest payment	355.2	207.6	252.1	735.9	1,469.8	2,249.7	2,107.5
(A)/M2(%)	2.3	1.8	9.6	20.3	31.4	29.5	22.7

Source: Monthly Bulletin, The Bank of Korea.

The establishment of open market is to be the most urgent to enhance the BOK's ability to influence interest rates and provide a broader base to influence the portfolio decisions of all financial institutions. In spite of various institutional and structural factors that limit open market operations, the BOK and the government initiated tentative steps in this direction. Though very limited in size and frequency, auctions are, now and then, held by the Bank for the sale of monetary stabilization bonds to the general public, including non-bank financial intermediaries. The BOK actively conducts sales of government and public bonds under repurchase agreements at prevailing market interest rates. The government depends increasingly on the issuance of government bonds rather than direct borrowings from the Bank.

As the rediscount policy and open market operations had only limited effect, the BOK frequently resorted to changes in the reserve requirements when controls on credit volume were called for. The uniform rates were introduced in February 1990. The reserve requirement ratio is now 11.5 percent while lower ratios are applied only to a few long-term time and savings deposits and non-residents' deposits.

In many cases when commercial banks were not able to meet required reserves and so had pay penalties, the BOK extended them general loans so that they could make up the reserve deficiency, thereby weakening the effectiveness of this instrument.

In addition to the orthodox monetary policy instruments mentioned above, the BOK is equipped with a wide range of direct or selective credit control instruments; determining maximum interest rates on deposits except for time deposits with maturities of more than two years, limiting the volume of bank credit, establishing required loan ratios to small and medium-sized enterprises, and prohibiting the issuance of loans to certain sectors.

B. Financial Reforms and M2 Velocity

Financial innovation in Korea may be characterized, if somewhat boldly, as having two basic types of innovation. The first were innovations that helped to economize the use of settlements account assets (currency and demand deposits) having either interest rates of zero or interest rates at low levels. Examples would include economization on the use of currency through credit cards, household checks, automatic salary deposit, and so on. A second type of innovation created safe investment account assets that paid market interest rates such as CDs, Bond Management Fund (BMF), Cash Management Account (CMA), and Money in trust.

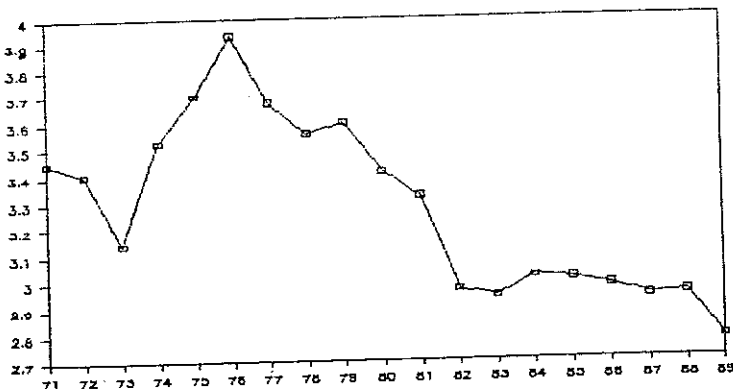
The introduction of such new financial instruments has made financial assets diversified and substitutability between them increased. In the course of these changes, it seems very likely that income velocities have also undergone structural changes.

M2 velocity has shown a long-term downward trend, falling at a 1.8 percent annual rate since the latter half of the 1970s, although revealing several quite distinctive movements such as the exceptionally sharp decline in 1982 and shortlived minimal spurts in 1979, 1984 and 1988 as shown in Figure 1.

After the unprecedented 10 percent drop in 1982, however, the downward trend in M2 velocity apparently weakened averaging a 0.9 percent rate of decline from 1983 to 1989. (See Appendix 1). A long-term downward trend of M2 velocity can be interpreted by the various factors, such as price stability and higher income growth, the development of non-bank financial institutions improving of cash management techniques and convenient means of payments, and reduction of the opportunity cost for holding M2.

One of the most prominent accomplishments during 1980s was the remarkable reduction in the inflation rate. The rate of increase in consumer price (CPI) had reached as high as above 20% per year in the early 1980s. But it was stabilized to 2%-3% per annum from 1983 to 1987. The basis for price stability was largely retained until 1989. The real GNP growth rate reached 8.4% per year during 1981 to 1985. The economic

Figure 1
TRENDS IN INCOME VELOCITIES OF M2



growth rate reached over 12% per year for three successive years from 1986 to 1988 and per capita GNP rose to above 4,000 U.S. dollars in 1988. Therefore, the three years from 1986 to 1988 can be characterized as marking the simultaneous accomplishment of three of the ultimate targets of economic policy: namely, high economic growth, price stability and balance of external transactions. The demand for financial assets has been greatly expanded due to high income growth and price stability. There was a remarkable flow of funds of households and enterprises into high-yielding deposit instruments offered by non-bank financial institutions, such as Bond Management Fund (BMF), Cash Management Account (CMA) and money in trust with liquidity and high returns. In addition, as cash management techniques improved and convenient means of payments such as credit cards and household checks were introduced, individuals tended to economize on their holdings of money balances.

In theory, much of the intermediate-run variability (the one to two-year intervals) in velocity measure can be explained by changes in the opportunity cost of holding M2 balances, defined as a market interest rate less the average rate paid on M2 deposits. Those changes, in turn, depend on the rate setting behavior of depository institutions: the more quickly and the more fully deposit rates adjust to changes in market rates, the more stable will be the opportunity cost of M2 and, therefore, the more stable will be V_2 (velocity of M2) itself. As the interest rate on M2 has been regulated by the Korean government, its adjustment to changes in market rates has been very slow, so that the opportunity costs vary significantly over the intermediate run. When the opportunity cost for M2 increase, the velocity of M2 increase, and vice versa. There should be a positive relation between the opportunity cost and V_2 . As there have been a lot of differences between regulated rates and market rates due to the slow adjustment of regulated rates to change in market rates. Empirically, the stable relation between V_2 and M2's opportunity cost might not be existed in the past variability of V_2 in Korea.⁴ An increase in the opportunity cost for M2 may have contributed the easing of the downward trend of M2 velocity.

C. Financial Internationalization and Monetary Policy

An important point concerning the internationalization of the financial structure is the effect that fluctuations of the foreign exchange market through international mobility of capital have on the management of

³ The interest rate is 4% per year.

⁴ The opportunity cost of M2 is measured by the corporate bond rate less the average rate paid on M2 deposits. This empirical results was obtained by the Bank of Korea.

monetary policy, monetary control in particular. The enhanced role of market forces in determining exchange rates, along with the overall liberalization of financial and capital markets, increases the interaction between, money supply, interest rates and exchange rates. For example, the higher money supply will lead to a decreased interest rates in the short run, which cause the exchange (W/U\$) to depreciate. As interest and exchange rates are increasingly reflecting the market forces and the restrictions on international mobility of capital are eased, the linkage between the two factors are becoming even closer and the interactions of monetary policy. These constraints are reflected in a reduced ability to influence the instruments of monetary policy (like the nominal money supply), in a reduced ability to influence the targets of monetary policy, or in an increased prudence in using monetary policy because of the potentially undesirable effects on expectations.

The external sector, while imposing severe constraints on monetary policy, is also providing the monetary authorities with useful information. An information from the foreign exchange market can be used in combination with data on interest rates to provide the monetary authorities with useful information on money market conditions. The following suggest a possible relationship between the exchange rate, the real interest rate, and the expected rate of inflation (relative to the corresponding foreign rates) under a floating exchange rate and perfect capital mobility.

$$(3-1) \quad e_t = e_{t-1} + [(p_t - p_{t-1}) - (p_t^* - p_{t-1}^*)] + [(r_t^* - r_{t-1}^*) - (r_t - r_{t-1})] \\ + E_t [e_{t+1} - (p_{t+1} - p_{t+1}^*)] - E_{t-1} [e_t - (p_t - p_t^*)]$$

Where e_t denotes the logarithm of the exchange rate in period t ; E_t denotes the expectation operator (based on information available at period t), and thus $E_t e_{t+1}$ denotes the expected logarithm of the exchange rate for period $t+1$ based on the information available at period t ; and r_t and r_t^* denote the real rates of interest on domestic and foreign securities that are identical in all respects except for the currency denomination.

Equation (3-1) demonstrates the relation between the exchange rate and the components of the nominal rate of interest.⁵ The first bracketed

⁵ The distinction between the roles of real and nominal rates of interest has been emphasized by Frankel (1979). The framework underlying equation (3-1) is based on Isard (1983). See also the discussion in Edwards (1983). The interpretation of the empirical record in terms of the three bracketed terms in equation (3-1) should be viewed as only suggestive.

term in equation (3-1) suggests that a rise in the domestic rate of inflation relative to foreign inflation is associated with a depreciation of the domestic currency (a rise in e_t). The second bracketed term in equation (3-1) suggests that a rise in the domestic real rate of interest relative to the foreign rate is associated with an appreciation of the domestic currency (a fall in e_t). The additional terms on the right-hand side of equation (3-1) describe differences in expectations concerning real exchange rates. The different relations between the exchange rate, on the one hand, and the two components of the nominal interest rate, on the other, form the basis for the policy description specified below.

The combination of a high nominal interest rate differential and a depreciation of the domestic currency suggest that the important factor underlying an increase in the nominal interest rate indicates a rise in inflationary expectations. On the other, the combination of a high nominal interest rate differential and an appreciation of the currency indicate the high real interest rate rather than inflationary expectations. The policy prescriptions call for fundamentally different monetary policies. To combat inflationary expectations, monetary policy has to be tight; but to combat high real rates of interest, monetary policy should be more relaxed.⁶

Looking back on ten years of experience under a multiple-basket pegged system⁷ in Korea, it would be difficult to say that the exchange rate has reflected market forces more precisely as shown by Table 4. This fact may be due to heavily managed floating systems by severely restricting capital flows.

IV. Monetary Targets and Exchange Rate: An Analytical Framework

This section focuses on building a framework for analyzing the determination of nominal interest rates and exchange rate in a small, open economy with a managed exchange rate and a domestic financial market

since in practice these terms represent endogenous variables that need to be explained, along with the exchange rate, in terms of the exogenous variables.

⁶ This argument draws on Frenkel and Mussa (1980, 1981) and Frenkel (1981).

⁷ The Bank of Korea concentration base rate, which was basic to determining such other rates as the interbank rate and the customer rate under the system, was calculated as follows:

- a) The Korean Won-U.S. dollar exchange rate was calculated on the basis of the SDR basket and a trade-weighted basket by averaging the two basket rates according to their assigned weights.
- b) The rates against foreign currencies other than the U.S. dollar was determined by arbitrating between the U.S. dollar rate of the currency in the international exchange market and the above Won-U.S. dollar concentration base rate.

Table 4
MAJOR INDICATORS IN MONEY, INTEREST RATE, EXCHANGE RATE

	81	83	84	85	86	88	89	90	91
Change in Exchange Rate (₩/U\$) ¹⁾	-5.8	-5.9	-3.9	-7.1	3.3	15.8	0.7	-5.1	-5.8
Yield on Corporate Bonds (%) ²⁾	24.2	14.2	14.2	14.2	12.8	14.5	15.3	16.4	18.8
Growth of M2 (%) ³⁾	27.4	19.5	10.7	11.8	16.8	18.8	18.4	21.2	18.6
Current Balance (billion U\$)	-4.6	-2.7	-1.4	-0.9	4.6	14.2	5.1	-2.1	-8.9

Notes: 1) Year-end

2) Guaranteed and floating rate

3) Averages

Source: Monthly Bulletin, The Bank of Korea.

that is being liberalized, like Korean economy. The model in this section is a kind of the extended and modified Mundell-Flemming model. Policy makers are now faced with a difficult issue relating to consistency between monetary targets, interest rate and exchange rate. From a policy perspective in developing countries with the short experience of financial liberalization, it is important to find a strategy or monetary mechanism manipulating both exchange rate adjustments and interest rate change by maintaining a target range for monetary aggregates. To this end, an aggregative macro-economic model of an open developing economies is necessary to be developed for actual implementation of monetary policy.

A. Basic Theoretical Model

1) The IS Relationship

The main task of this section is to adapt the IS-LM equations applicable to an open economy, which reflects the Korean economy as possible as we can. The first step in constructing the model is to consider the specification of a relationship that corresponds to the IS function.

The national product identity with foreign trade is,

$$(4-1) \quad Y = C(Y, r) + I(Y, r) + G + X(Q, \frac{Y}{Y^*})$$

Private demands for consumption (C) and investment (I) depend on the level of income (Y) and the real interest rate (r). With respect to net exports (X = exports minus imports), the magnitude of X will depend negatively on the price of export goods relative to import goods, denoted Q, and negatively on the level of domestic real income relative to incomes abroad, Y*.

To keep the number of variables as small as possible, we shall not express Y* and G explicitly but shall include their influence as part of a stochastic disturbance term. Then defining $y_t = \log Y_t$ and $q_t = \log Q_t$, equation (4-1) becomes

$$(4-2) \quad y_t = a_0 - a_1 r_t - a_2 q_t + u_t$$

Following the standard Fisher approach, we can specify the nominal interest rate as equal to

$$(4-3) \quad i_t = r_t + \Pi_t^e \text{ or } r_t = i_t - \Pi_t^e$$

where

- i = the domestic nominal rate of interest
- r = the real interest rate
- Π^e = the expected rate of inflation

Then the relative price of domestic to import goods will be expressed as $Q = P/P^* \cdot E$. Suppose that p^* is the (average) price of imports in terms of foreign currency. To be comparable with the domestic price of domestic goods, we must multiply p^* by the prevailing exchange rate (E), defined as the price of the foreign currency in terms of the domestic currency. As our model is being formulated in terms of the logarithms of those variables, the relevant expression for period t will be written as

$$(4-4) \quad q_t = p_t - (e_t + p_t^*)$$

where e_t is the log of the home-country's exchange rate, E_t and $p_t^* = \log P_t^*$. Substituting equation (4-3) and (4-4) into equation (4-2) produces the IS relation in terms of price variable as follows:

$$(4-5) \quad y_t = a_0 - a_1 (i_t - \Pi_t^e) - a_2 (p_t - e_t - p_t^*) + u_t$$

To allow for continuing inflation in the home country and the rest of the world and its effect on the terms of trade (equation (4-4)) we can write

$$(4-4) \quad q_t - q_{t-1} = \Pi_t - \Pi_t^* - \dot{c}_t$$

which indicates that $\Pi_t = p_t - p_{t-1}$, $\Pi_t^* = p_t^* - p_{t-1}^*$, and $\dot{e}_t = e_t - e_{t-1}$. From equation (4-4) we know that the IS curve will keep shifting to the left or to the right unless q is constant, which requires $\Pi_t = \Pi_t^* + \dot{e}_t$; that is, the terms of trade are constant. For instance, q_t is rising over time and demand for home goods will keep falling and the IS curve will keep moving to the left, if $\Pi_t > \Pi_t^* + \dot{e}_t$.

2) The LM Relationship

The openness of the economy does not basically change the demand side of the money market. The demand for real money balances is determined by real income and by the domestic nominal interest rate. We use again the log-linear relation, namely,

$$(4-6) \quad m_t - p_t = b_0 + b_1 y_t - b_2 i_t + v_t$$

Here, m_t denotes the log of the (domestic) money stock and interest rate is not expressed in natural log.

Equation (4-6) can be converted into an equilibrium condition for the money market if the left side is redefined as the supply of real money. In Korea, monetary policy targets are stated in terms of an acceptable range for the growth rates of the money supply. To incorporate the requirement that monetary policy controls the growth rate of the nominal money supply we can link levels and changes in levels from one period to the next by

$$(4-7) \quad dm_t - \Pi_t = (m_t - p_t) - (m - p)_{-1}$$

Where dm_t is the exogenously determined growth rate of the money supply and Π is the inflation rate. If $dm > \Pi$, then real money balances are growing over time as the central bank is pumping money into the economy faster than it is being drained by the loss of purchasing power. If $dm = \Pi$, then nominal money balances are rising with time but real money balances are constant.

The equation for the LM curve where supply and demand in the money market are equal, is derived by substituting equation (4-7) into equation (4-6) to arrive at

$$(4-8) \quad dm_t - \Pi_t = b_0 + b_1 y_t - b_2 i_t - (m - p)_{-1} + v_t$$

The LM curve will not remain in place unless $dm_t = \Pi_t$. If $dm_t > \Pi_t$, $m - p$ will be increasing through time and the LM curve will move steadily down and to the right.

The domestic nominal interest rate is now linked to i^* and $E(e^*)$. The following interest-parity relation will hold.

$$(4-9) \quad i_t = \theta [i_t^* + E(\dot{e}_t)] + k$$

where i_t^* is the world interest rate for a financial asset of the same characteristics (maturity and so on) as the domestic instrument and $E(\dot{e}_t)$ is the expected rate of change of the exchange rate. This flow version of the Fisher hypothesis implies that $\theta = 1$; that is, changes in the expected rate of return on foreign assets should result in an equivalent change in the domestic interest rate. It means the economy is completely open to the rest of the world. A value of θ lower than unity would imply less than full adjustment, arising, for example, from interference with the free flow of capital. The Korean economy under consideration is one that has some controls on capital movements, as most developing countries do. The parameter θ can be interpreted as an index measuring the degree of financial openness of the country. In the intermediate case of a semi-open economy, θ will lie between zero and unity. It can be estimated by way of the empirically estimated economic degree of openness or the legal degree of openness given by the system of capital controls in the country.⁸

k includes the effects of regulations, restrictions, monetary disequilibrium in domestic money market, and so on. Equation (4-9), therefore, will be utilized as one of the basic relationship in our model.

The aggregate supply side of the model could be formulated as:

$$(4-10) \quad \Pi_t = c_1 (y_t - \bar{y})_t + \Pi_t^e$$

Equation (4-10) is a standard expectation — argumented Phillips curve. The inflation rate is dependent on the difference between actual and potential output.

B. Properties of the Model

The model that we have specified above is made up of equations (4-2)–(4-10). The model for policy analysis can be rewritten as:

$$(4-5) \quad y_t = a_0 - a_1 (i_t - \Pi_t^e) - a_2 q_t + u_t$$

$$(4-8) \quad dm_t - \Pi_t = b_0 + b_1 y_t - b_2 i_t - (m-p)_{-1} + v_t$$

⁸ See Edwards and Kahn (1985).

$$(4-10) \quad \Pi_t = c_1 (y_t - \bar{y})_t + \Pi^e$$

$$(4-9) \quad i_t = \theta [i_t^* + E(\dot{e}_t)] + k$$

$$(4-4) \quad q_t = \Pi_t - \Pi_t^* - \dot{e}_t + q_{t-1}$$

Equation (4-5) is the IS curve, (4-8) is the LM curve, (4-10) is the aggregate supply curve, (4-9) is the interest parity condition, and (4-4) is a definitional equation for the terms of trade. u and v are domestic shocks to the goods market and money market, respectively. Their expected value is zero, but they may take on positive or negative values and therefore represent unexpected events to which the economy must react. In addition k is foreign stocks that are transmitted in equation (4-9) to the home economy. k includes the forecast error in predicting the future exchange rate and the departures from interest parity arising from the risk premium and other institutional or structural factors.

The long-run equilibrium requires that expectations will be correct, in other words, $\Pi_t^e = \Pi_t$ and $\dot{e}_t = E(\dot{e}_t)$. In addition, it also requires that $\Pi_t = \Pi_t^* + \dot{e}_t$; otherwise the IS curve would continue to shift over time. Finally, the growth rate of the money supply must equal the domestic inflation rate, $dm_t = \Pi_t$. And the disturbance terms become $v_t = 0$, $u_t = 0$ and $k = 0$.

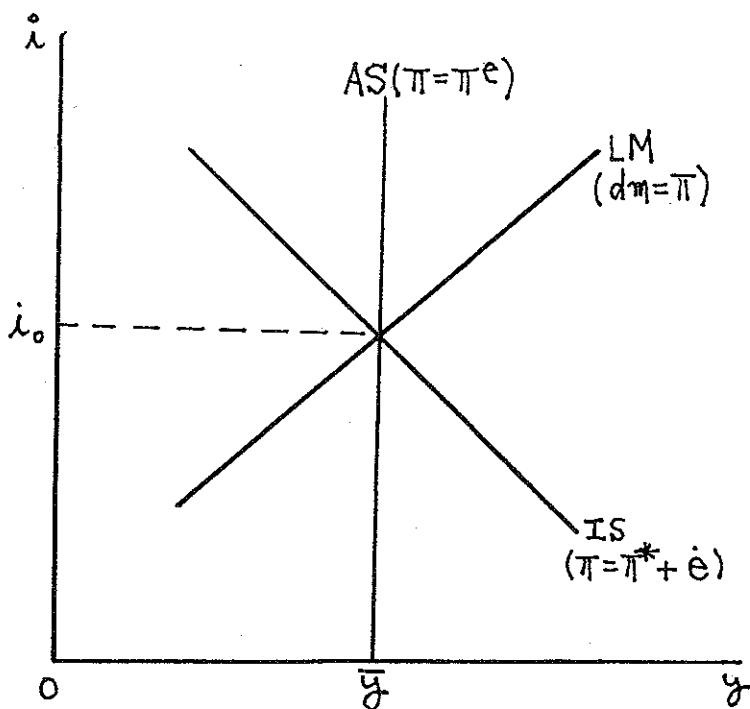
This model is very flexible. It is assumed that \bar{y} and Π^e are given from outside the model, that Π^* and Π^e are exogenous to the economy under study, and that m_t is determined by the monetary authority. Thus the only endogenous variables appearing in the system are y , i , Π , and \dot{e} . The model can determine y , Π , i , and \dot{e} in the following sequence: equations (4-5) and (4-8) are used to solve for y and i as functions of Π and \dot{e} and the exogenous variables. Then these expressions are substituted into equations (4-9) and (4-10) to get Π and \dot{e} . With movements of these variables determined, we can then go back to equations (4-3) and (4-4) to easily derive implications for r and q .

The initial IS, LM and AS curves are drawn in figure 2. In all three curves the disturbances are assumed to be zero to indicate a long run equilibrium position for the economy. In the long-run, only one combination of dm and \dot{e} is possible: $dm = \Pi$ and $\Pi = \Pi^* + \dot{e}$.

C. The Choice of Policy Instruments: Money Supply or Exchange Rate

As the economy becomes more open to the world, it becomes gradually not possible for the central bank to choose between control over the

Figure 2
LONG-RUN EQUILIBRIUM OF AN OPEN ECONOMY



money supply and control over interest rates. Instead, the choice is between the money supply and the exchange rate. If the capital mobility increases and approaches to a perfect degree, the domestic interest rates are greatly affected by foreign factors such as foreign interest rates and exchange rates as shown by the interest parity condition. That implies the scope of controlling over interest rates by use of domestic factors becomes very narrow. In this changing situation, the central bank can allow an economic shock to be absorbed by exchange adjustments while maintaining the existing growth rate of money supply, or by money supply adjustments while the exchange rate is held to some predetermined value. In any event, it must be emphasized that the interest parity condition does not imply that current period values of i_t are dictated by external conditions alone, for i_t and e_t are both variables that are determined endogenously in our model.

1) Random Shocks and Policy Responses

In a closed economy, the central bank has the choice of controlling the money supply or the nominal interest rates. If the monetary authorities are convinced that shocks are mainly of a monetary nature, interest-rate control has been found to be optimal: if, on the other hand, the shocks are likely to be in goods market, controlling the money supply is the best strategy: if both types of shock exist, the optimal mechanism involves a weighted average of money supply and interest-rate control with the weights determined by the size of the variance of the two disturbances.⁹

In an open economy with managed exchange rate, the monetary authorities let the exchange rate yield to supply and demand conditions and maintain a target growth rate of the money supply, and at other times the exchange rate itself becomes a target and the money supply is demand-determined. If they choose the right mechanism at the right time they can overcome completely the efforts of domestic money market and goods-market shocks.

Consider first a monetary shock in the home economy that causes v_t in eq. (4-8) to be positive.¹⁰ It is assumed that all expectational variables remain constant in the short-run. Also all foreign variables and u_t are unaffected.

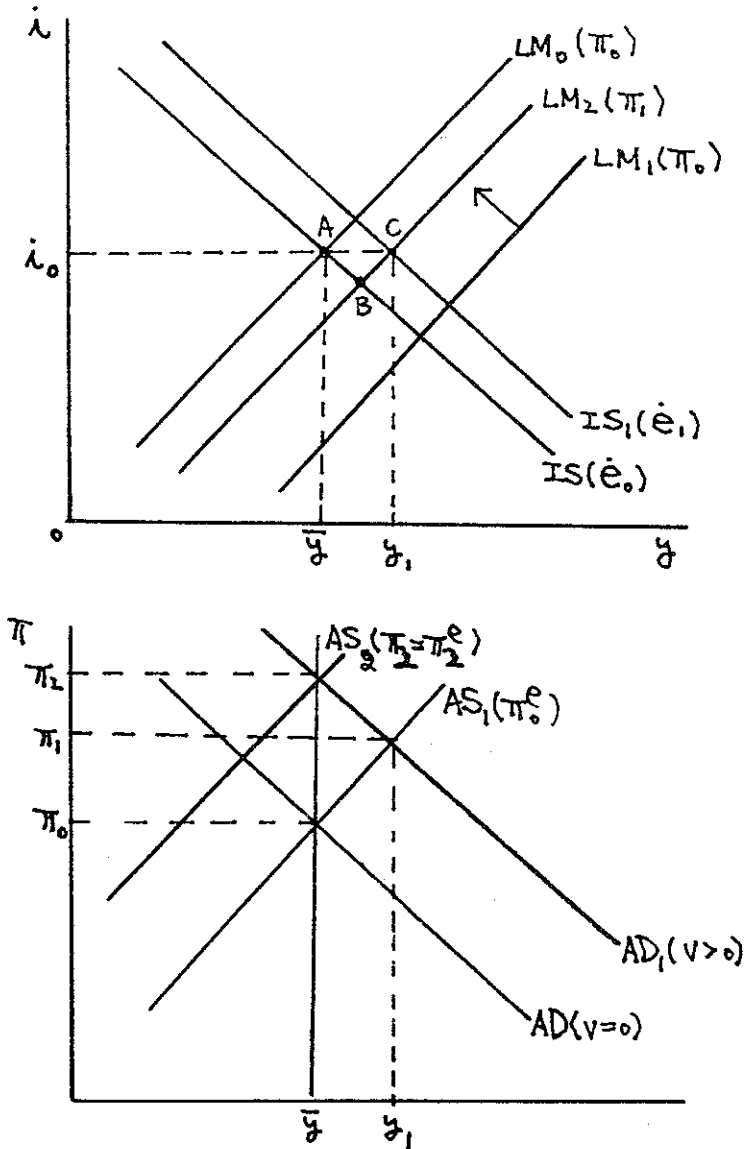
The LM curve shifts to LM_1 as the real money supply starts to grow. This is shown in Figure 3. As the AD curve begins to shift to the right, we find that both Π_0 and y rise to Π_1 and y_1 , the higher inflation in turn causes the real money supply to fall, and the LM curve shifts back to LM_2 , that shift to point B would involve a domestic interest rate less than the foreign rate. This tendency causes a capital outflow. If the central bank does not change in dm , then \dot{e}_0 will rise to \dot{e}_1 due to the rise in Π_t and a capital outflow. As the depreciation of the domestic currency is not completely offset by the higher domestic inflation, the depreciation of the domestic currency (\dot{e} rises) causes the terms of the trade (q) to fall. This stimulates net exports, so the IS curve shifts to the right, IS_1 , and the economy moves to point C, whose location is dictated by the need for y_1 , to be the same in the IS-LM diagram as in the AD-AS diagram.

As an alternative, the central bank could maintain the existing value of \dot{e} and let the resulting balance of payments deficit automatically reduce

⁹ Poole (1970) and Leroy and Lindsey (1978).

¹⁰ $u_t > 0$ represents an increase in the growth rate of the money supply with the same features as dm_t except for the fact that the central bank is unaware of its existence. If the authority maintains dm at certain level, then $dm + u$ leads to a volatile growth rate of money supply.

Figure 3
DOMESTIC MONETARY SHOCK AND ITS EFFECT



the value of dm . In Figure 3, this is shown as LM shifting to the right to LM_1 , and immediately returning to its original position in point A. Monetary shocks do not influence the IS curve when \dot{e} is controlled. In addition, the $u_t > 0$ is offset by $dm_1 - dm_0$ of equal value, but opposite sign, so that the sum of the expected and unexpected growth rates of the money supply remains constant. Exchange-rate control provides a complete and automatic stabilizer to money market instability in the form of positive or negative disturbances.

From this comparison, it is possible to offer a fairly strong conclusion. If the open economy has an unstable LM curve, the existing equilibrium can be preserved by holding to the predetermined path of exchange rate when monetary shocks arrive. Any tendency of the exchange rate to move away from its previous value should be resisted by forcing the growth rate of the money supply to be the shock absorber. This recommendation holds whether the shocks are transitory or persistent as long as they are monetary in nature and domestic in origin.

As a second experiment, suppose that domestic goods-market shock (u_t) takes on a positive value as investment expenditures rise unexpectedly. This has a tendency to raise the domestic interest rate (IS curve shifts to the right), which in turn causes a capital inflow. With money-supply control, this inflow is translated into an appreciation of the domestic currency or \dot{e} falls. The appreciation of domestic currency means that net exports are reduced, so the IS curve shifts back to its original position. The extra investment expenditures are offset by reduced net exports. Therefore controlling the money supply insulates the economy from domestic goods-market shocks.

If the exchange rate is controlled, the result is quite different. A tendency to raise the domestic interest rate causes a capital inflow. An inflow causes the increase in the domestic money supply, which in turn raise the inflation rate by shifting the AD curve to the right. Then higher inflation causes the terms of trade to rise and IS curve shift "partially" back to the original position. The end result is that y rises over \bar{y} . In this case the extra investment expenditures are not completely displaced by a reduction in net exports.

From this comparison, goods market shocks are best accommodated by having a money-supply goal and sticking to it. This is exactly the same conclusion as for a closed economy. But how do we know where the shocks come from? The movements in i , y , and Π give signals as to the shocks that caused them. If i falls but y and Π rise, we know that a positive u_t is the source of the problem. From this differences between u and v the central bank has sufficient information to make the switch between money-

supply control and exchange-rate control.

2) Actual Applications for Policy Guidelines

As Korean economy proceed to liberalize the domestic financial systems and to remove restrictions on capital flows, the issue of interest rate and exchange rate determination becomes increasingly important. In particular, how interest rates and exchange rates can be expected to behave in the changed environment and how they will respond to foreign influences and domestic monetary policies are questions that policy makers must consider.

Could the central bank have both monetary and exchange-rate targets? It is possible within limits, to achieve both monetary and exchange rate targets by having a target range for monetary aggregates. As long as a targeted growth rate of monetary aggregates remains within this range, the central bank can manipulate the interest rate in order to achieve a particular level of exchange rate that the authorities wish to reach. For example, if the trend growth of the money supply is relatively strong, and is above the center of the target range, the central bank has to judge whether there is now room for some increase in short-term interest rates without prejudicing the achievement of an acceptable rate of monetary expansion or not. When it is possible, some increase in short-term rates would moderate the downward pressure on the (Korean won) and would contribute to more orderly conditions in the foreign exchange market in Korea.

We have derived a theoretically consistent model that can serve as a model for policy analysis. We now try to formulate the model to be applicable to the empirical estimations. The model developed in Section 4.2 can be used for this purpose. The derivation concentrates on the interest-rate and exchange rate determination that ensure consistency with a monetary target for a practical point of policy guidelines.

From equation (4-8) the LM curve can be used to the interest-rate determination.

$$(4-8) \quad i_t = [1/b_2] [b_0 + b_1 y_t + \Pi_t - dm_t - (m-p)_{-1}]$$

We can see that there is only one i that is consistent with projected values for y_t and Π_t , with a targeted value for dm_t , with the assumption that $v_t = 0$ and with a known value for $(m-p)_{-1}$. Parameters b_1 and b_2 are estimated by the standard demand for money function in equation (4-6).

The interest-rate determination can also be derived by the IS-LM curve. Equations (4-5) and (4-8) to solve for i is functions of exchange

rates and inflation rates and dm_t .

$$(4-11) \quad i_t = \alpha_0 + \alpha_1 \Pi_t - \alpha_2 q_{t-1} - \alpha_3 [dm_t + (m-p)_{-1}]$$

Equation (4-11) incorporates the principal determinants of interest rates such as foreign inflation, change in exchange rates, and domestic monetary developments.

The IS curve (equation 4-5) allow us to calculate the rate of change of the exchange rate.

$$(4-5)' \quad \dot{e}_t = [1/a_2] [y_t - a_0 + a_1 (i_t - \Pi_t^e)] + \Pi_t - \Pi_t^* + q_{-1}$$

Equation (4-5) indicates that the percentage change in the nominal exchange rate is positively related to the real interest rate and differences between the rate of inflation in domestic and foreign price level. It suggests that a fall in the real interest rate relative to the foreign rate, and a rise in domestic rate of inflation relative to foreign inflation, are associated with a depreciation of the domestic currency.

To explain direct relationship between the exchange rate and the targeted growth rate of the money supply, equation (4-11) derived by the IS-LM is substituted into equation (4-9) with the assumption that $k = 0$ and $\dot{e} = E(\dot{e}_t)$.

$$(4-12) \quad \dot{e}_t = \beta_0 - \beta_1 (\Pi_t - \Pi_t^*) - \beta_2 q_{-1} - \beta_3 (dm_t + (m-p)_{-1}) - i^*$$

Equation (4-12) makes little difference in equation (4-5) except demonstrating the direct relation between the exchange rate and the targeted value of the money supply.

Let us take an example to investigate how to operate the working mechanism. The growth rate for M2 is between 10% and 14%. With values for all the variables and parameters on the right hand side of equation (4-11), the central bank estimates that interest rates could range between 12% and 15%. Given an estimate of i and dm , equation (4-12) is used to estimate the rate of change in the exchange rate. If the interest rate remains within the range 12-15%, the central bank is assured that the growth rate of the money supply was within the bounds that it had set and it would not alter its current stance. If the interest rate is higher than the upper bound, 15%, then the Bank has reason to believe that the money supply is growing more slowly than it wanted. In response, it would increase open market purchases to push the growth rate of the money supply up and lower the interest rate to the bounds. In fact it can

calculate precisely the adjustment of the growth rate of the money supply by equation (4-8) or (4-11) that is needed. In an open economy, equation (4-9) stipulates that $i_t = \theta[i_t^* + E(\dot{e}_t)]$. The influence from foreign domination of domestic interest rates involves allowing the exchange rate (e) to absorb some of the adjustment that allows for manipulation by use of equation (4-5) or (4-12). On the other hand, the Bank could maintain a specific range for the exchange rate by manipulating the interest rate as long as the growth rate of the money supply remains within the targeted range.

V. Conclusions

Though the model presented here has a fairly simple structure and its limitations, it is sufficiently general to be applicable to a variety of developing countries under managed exchange rates, that have undertaken policies of financial reform. Several developing countries under liberalization process are faced with the common policy problems on how to deal with a high degree of integration of domestic and world capital markets for the purpose of setting the guidelines for the monetary policy.

In this paper, we have derived a theoretically consistent model which highlights the role played by monetary targets. In addition, we showed the exchange rate could become either a target or an instrument. A theoretical discussion of the effects of a program of the monetary policy working through changes in the targeted growth rate of the money supply, interest rates, was done by the IS-LM model in the semi-open economy.

From a policy perspective, however, it is important to be able to empirically analyze their effects. But the usefulness of empirical model for analyzing policy effects in the developing countries may be limited. The main reason for this limitation is that the experience with liberalized financial markets is still relatively recent. The data for estimation of the model is not enough and also inadequate. Especially endogenizing the exchange rate has in most cases proved to be exceedingly difficult. Even the empirical models for the major industrial countries have not been particularly successful in predicting exchange movements.¹¹

By recognizing this empirical issue, we should be careful in applying the theoretical model to the empirical model and then interpreting the

¹¹ See Levich (1985) and Frankel and Meese (1987).

estimating results. Notwithstanding, we should try to do something about empirical estimations as a useful reference point for the guideline of the monetary policy.

Appendix 1 Trends in M2 Velocities

Year	M2 Velocities	Year	M2 Velocities
1971	3.45 (-3.9)	1981	3.32 (-2.8)
1972	3.40 (-1.2)	1982	2.97 (-10.6)
1973	3.14 (-7.6)	1983	2.94 (-1.0)
1974	3.52 (12.1)	1984	3.01 (2.5)
1975	3.70 (5.1)	1985	3.00 (-0.4)
1976	3.93 (6.2)	1986	2.98 (-0.8)
1977	3.68 (-6.6)	1987	2.92 (-1.8)
1978	3.56 (-3.2)	1988	2.88 (-1.5)
1979	3.60 (1.2)	1989	2.79 (-3.1)
1980	3.41 (-5.2)	1990	2.74 (-1.8)

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